(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : 0 646 685 A1

(12) EUROPEAN PATENT APPLICATION

(21) Application number : 94307260.3

(22) Date of filing : 04.10.94

(51) Int. Cl.[6] : E04G 13/02, B31C 11/04, F16L 9/16

(30) Priority : 04.10.93 US 131228

(43) Date of publication of application : 05.04.95 Bulletin 95/14

(84) Designated Contracting States : DE ES FR GB IT NL

(71) Applicant : SONOCO PRODUCTS COMPANY
One North Second Street
Hartsville South Carolina 29550 (US)

(72) Inventor : Bacon, Robert D., Jr.
835 West Home Avenue, Apt. B
Hartsville, South Carolina 29550 (US)
Inventor : Floyd, Arnold B., Jr.
110 Barefoot Street
Hartsville, South Carolina 29550 (US)
Inventor : Johnson, Troy W.Jr.
P.O. Box 895
Hartsville, South Carolina 29550 (US)
Inventor : Martin, James R.
204 Holly Drive
Hartsville, South Carolina 29550 (US)
Inventor : Whitehead, John F.
505 White Oak Circle
Hartsville, South Carolina 29550 (US)
Inventor : Bonds, Honor S.
3405 Ebenezer Chase Drive
Florence, South Carolina 29501 (US)
Inventor : Van de Camp, Wim
Humcovenderveld 14
NL-6231 HW Meerssen (NL)

(74) Representative : Linn, Samuel Jonathan et al
MEWBURN ELLIS
York House
23 Kingsway
London WC2B 6HP (GB)

(54) Concrete column forming tube having a smooth inside coated surface and method of making same.

(57) A concrete column forming tube (10) and method of making same for receiving poured concrete therein to produce a concrete column is characterised by a smooth inside coated surface (16) in the forming tube (11) to eliminate spiral seam lines and other undesirable characteristics on the outside surface of the formed concrete column. The tube (11) is formed from spirally-wound plies (12) of paper adhered together and has a centrifugally-cast epoxy resin coating (15) sprayed onto the inside surface (13) of the spirally-wound tube (11) while the tube (11) is rotating to produce a smooth inside coated surface (13) on the forming tube (11).

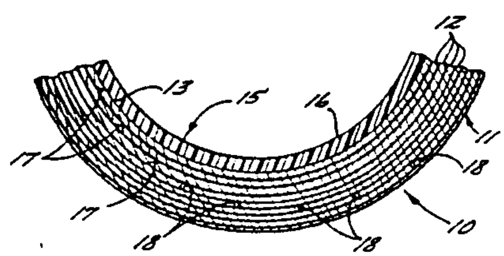

Fig. 2.

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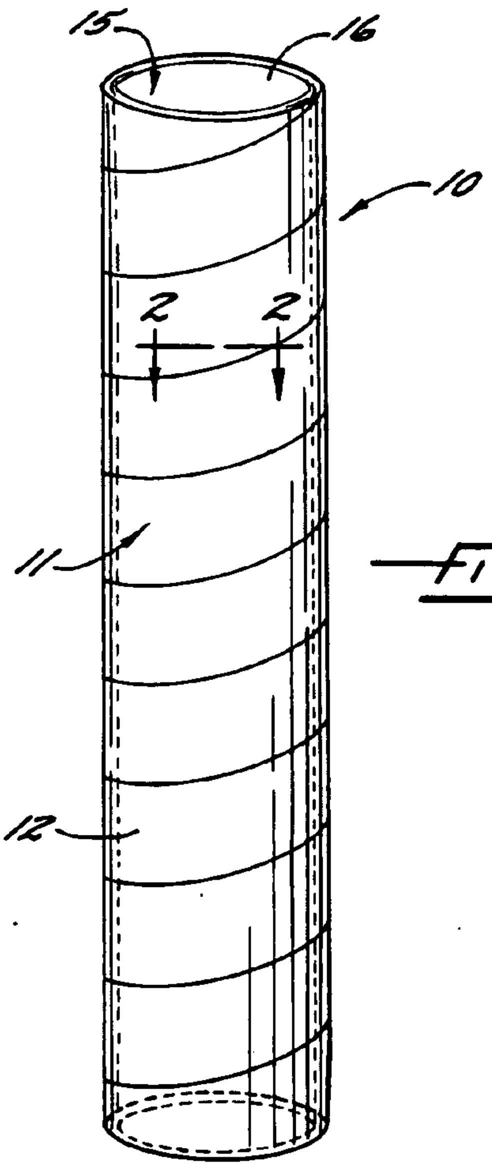


Fig. 1.

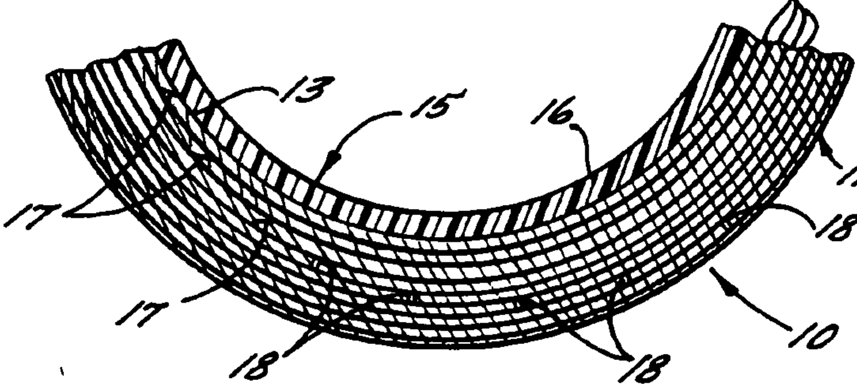
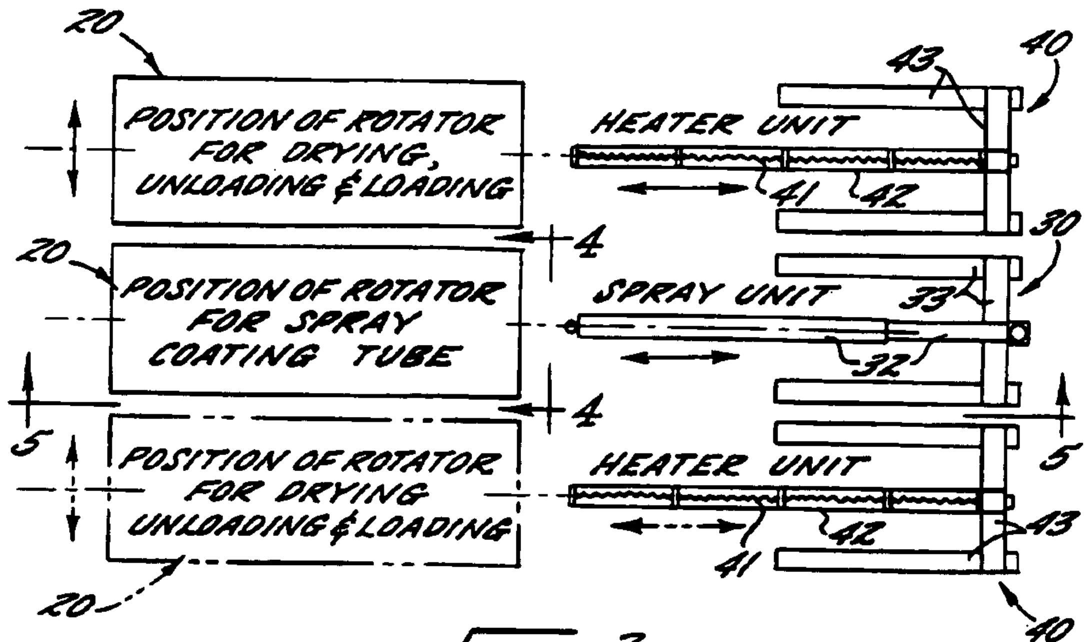


Fig. 2.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POSITION OF ROTATOR FOR DRYING, UNLOADING & LOADING
HEATER UNIT
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41
42
4
30
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POSITION OF ROTATOR FOR SPRAY COATING TUBE
SPRAY UNIT
33
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POSITION OF ROTATOR FOR DRYING UNLOADING & LOADING
HEATER UNIT
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Fig. 3.

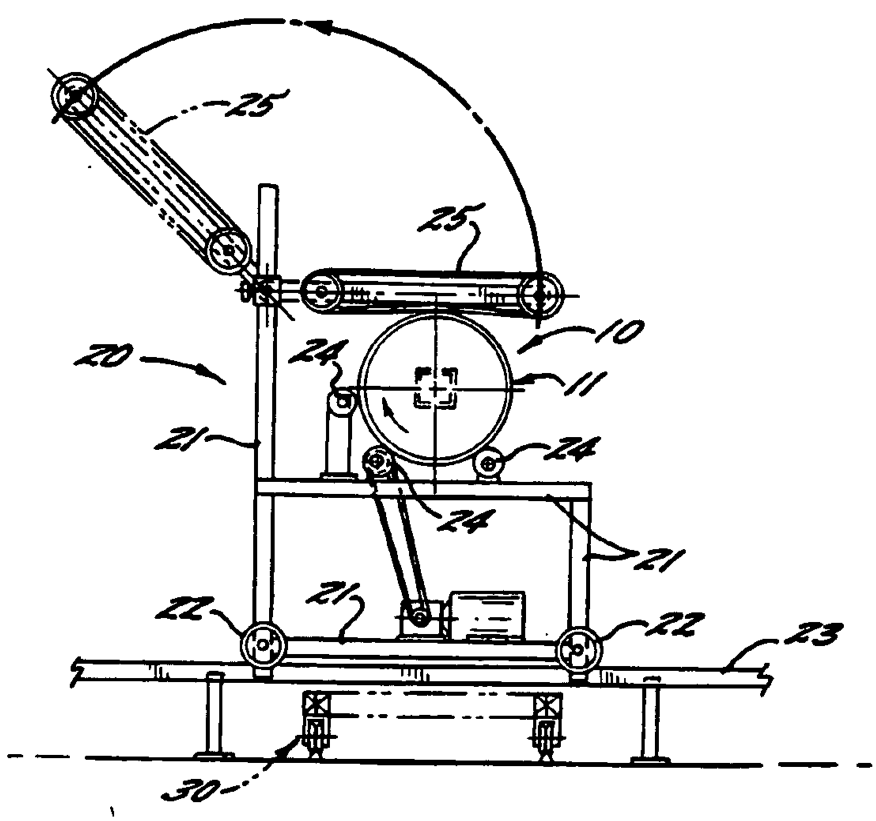
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Fig. 4.

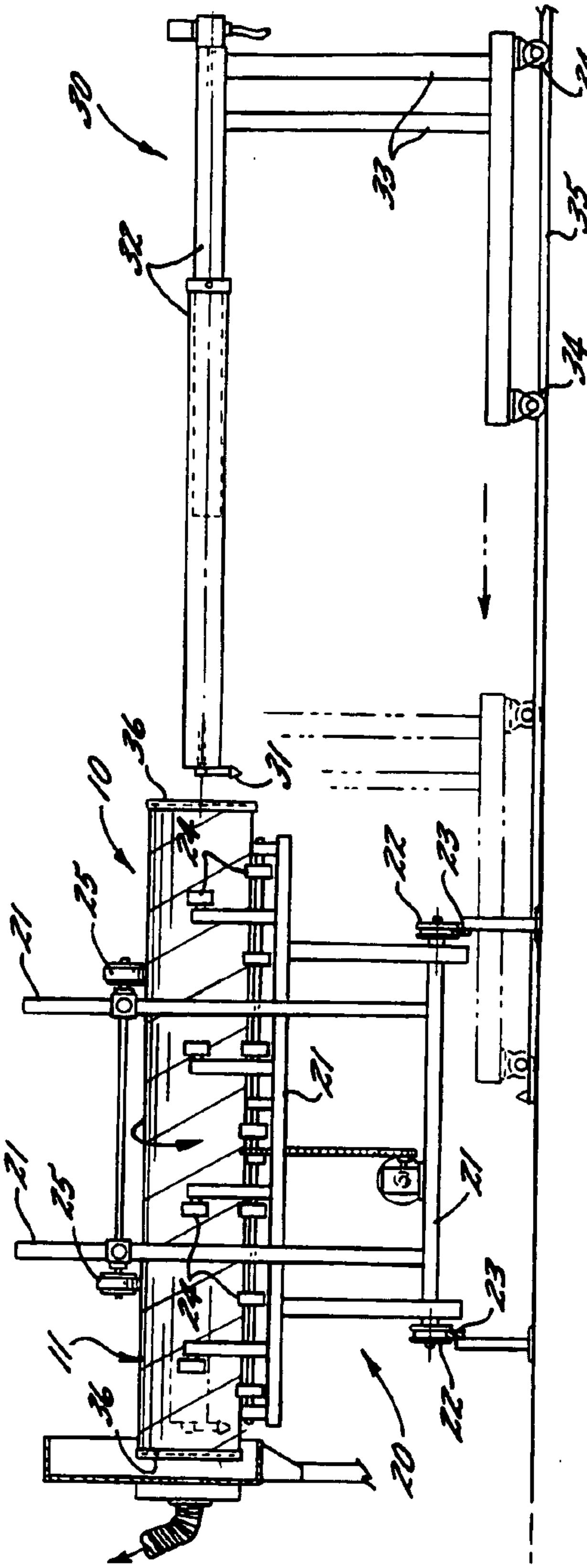
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Fig. 5.

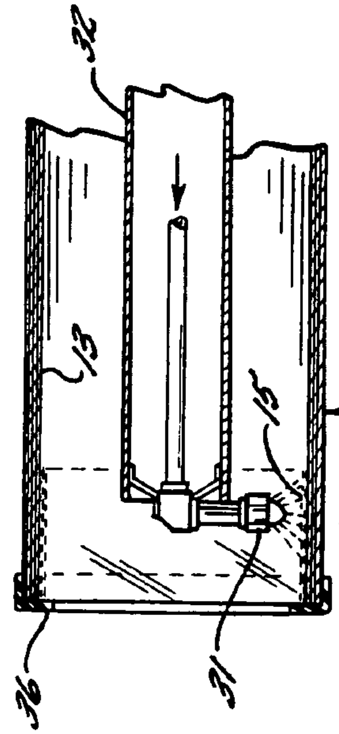
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Fig. 6.

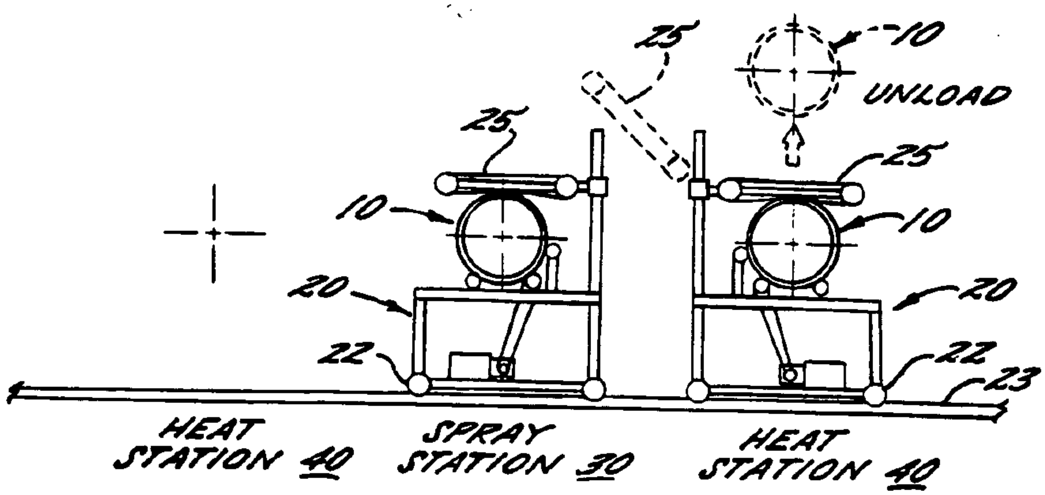

Fig. 7A.

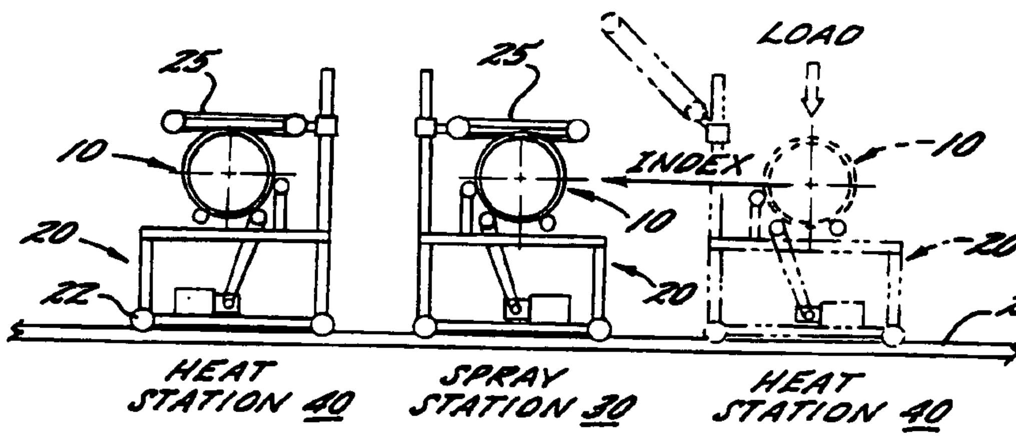

Fig. 7B.

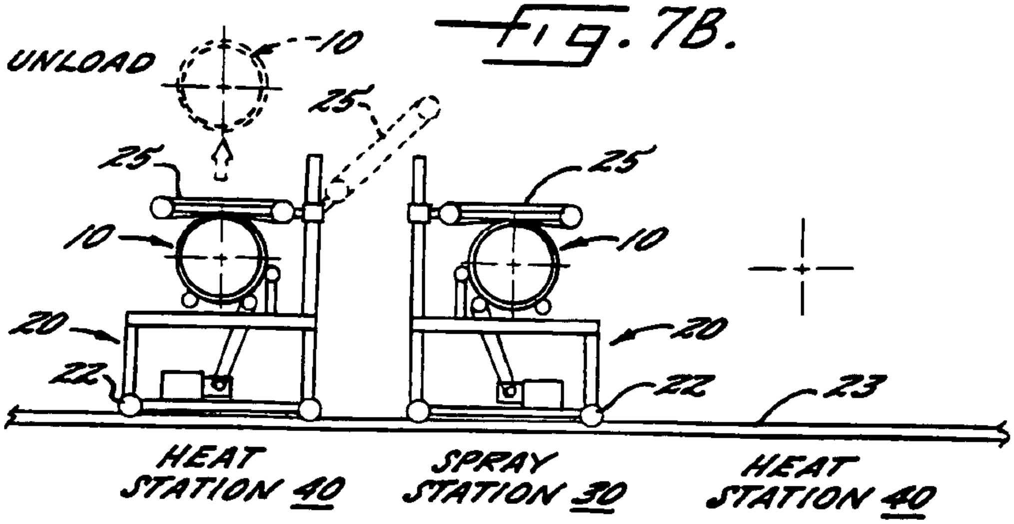

Fig. 7C.

Description

This invention relates to a concrete column forming tube and method of making same for receiving poured concrete therein to produce a concrete column and which utilizes an elongated cylindrical tube made of spirally-wound plies of paper adhered together and which is characterized by a smooth inside coated surface in the forming tube to eliminate spiral seam lines and other undesirable characteristics on an outside surface of the formed concrete column.

For many years, concrete column forming tubes have been utilized and have been constructed of spirally-wound plies of paper adhered together and defining an inside wall surface of predetermined diameter which is coated with plastic material for concrete release properties. This plastic coating was usually provided by coating one side of the paper plies prior to spiral winding of the tube. These forming tubes received poured concrete therein which dried and set-up to produce a concrete column. The forming tube was then stripped away from the concrete column and this operation was aided by the release properties of the plastic coating on the inside of the tube to leave a finished concrete column. These types of prior art tubes are illustrated in U.S. Patents 2,677,165 and 2,914,833, for example, which are assigned to the present applicant.

Due to the spirally-wound construction of these forming tubes, spiral seam lines and other undesirable surface characteristics were usually present on the inside wall surface of the forming tube which resulted in spiral seam lines and other irregularities molded on the outside surface of the produced concrete column. From an aesthetic standpoint, these spiral seam lines and other irregularities were often undesirable on the produced concrete column and sandblasting or other finishing techniques were necessary to produce a smooth outside surface on the concrete columns.

In an effort to overcome these problems, separately-formed flexible cylindrical liners have been proposed by U.S. Patent No. 4,595,168 and our own U.S. Patent No. 4,957,270. These separate liners were inserted into the concrete column forming tube after manufacture of the tube and often at the concrete column forming site. While these separate liners improved the surface quality of the resulting concrete column, they did often produce one vertical seam line running the length of the formed column, were expensive to manufacture, difficult to maintain and install and presented other problems in the manufacture and use thereof.

Accordingly, it is the object of this invention to provide a concrete column forming tube and method of making same for receiving poured concrete therein to produce a concrete column and which is constructed of spirally-wound plies of paper and which eliminates or ameliorates the problems discussed above with prior coatings and liners and provides a smooth inside coated surface in the forming tube which eliminates or ameliorates undesired spiral seam lines and other characteristics from being produced on the outside surface of the formed concrete column.

By this invention, it has been found that the above object may be accomplished by providing a concrete column forming tube which is constructed of spirally-wound plies of paper adhered together and defining an inside wall surface having spiral seam lines thereon, and a centrifugally-cast epoxy resin coating sprayed onto the inside wall surface of the spirally-wound paper tube while the tube is rotating to produce a smooth inside coated surface on the forming tube to eliminate spiral seam lines and other undesirable characteristics on an outside surface of the formed concrete column.

The preferred spirally-wound forming tube includes three inside plies having deckled overlapped edges and each having a Basis weight range of about 90-100 lbs./1000 square feet and a density range of about 3.6-4.0 lbs./point, and at least five outside plies having butted edges and having a Basis weight range of about 70-120 lbs./1000 square feet and a density range of about 2.7-3.5 lbs./point. The centrifugally-cast epoxy resin coating preferable comprises about 75-95% low viscosity multifunctional resin and about 25-5% accelerated aliphatic amine catalyst. The centrifugally-cast epoxy resin coating preferable has a thickness of about 0.010-0.125 inch.

The method of making the above described concrete column forming tube includes the step of providing an elongate cylindrical tube of spirally-wound plies of paper adhered together, centrifugally-casting an epoxy resin coating on the inside wall surface of the tube by depositing, preferable by spraying, the epoxy resin on the inside of the tube while the tube is rotating in the horizontal position. The centrifugally-cast epoxy resin coating is then cured, preferable by heating the epoxy resin coating to a predetermined temperature for a predetermined period of time.

While some of the objects and advantages of the present invention have been set forth above, other advantages may become apparent from the following description of a preferred embodiment of the invention when taken in conjunction with the accompanying drawings in which:

Figure 1 is a perspective view of a concrete column forming tube constructed in accordance with the present invention;
Figure 2 is a partial cross-sectional view through the concrete forming tube of Figure 1 and taken generally along the line 2-2 of Figure 1;
Figure 3 is a diagrammatic view of apparatus which may be utilized in the preferred method of producing the concrete column forming tube of this invention;
Figure 4 is an end elevational view of apparatus illustrated diagrammatically in Figure 3 and taken generally along the line 4-4 of Figure 3;
Figure 5 is a side elevational view of apparatus illustrated diagrammatically in Figure 3 and taken generally along the line 5-5 of Figure 3;
Figure 6 is an enlarged partial sectional view illustrating spraying of coating on an inside surface of a tube while being rotated by a rotator device; and
Figure 7A, B and C are schematic in elevational views of the two rotator devices illustrated in Figure 3 and showing these devices in three different positions during operation of such devices to perform the preferred method of making concrete column forming tubes in accordance with this invention.

Referring now to the drawings, there is illustrated in Figures 1 and 2 a concrete column forming tube 10 for receiving poured concrete therein to produce a concrete column and which is constructed generally in accordance with the present invention.

This concrete column forming tube 10 comprises firstly an elongate rigid cylindrical tube 11 constructed from a plurality of spirally-wound plies 12 of paper adhered together and defining an inside wall surface of predetermined diameter and having spiral seam lines thereon as a result of the spiral winding of the plies 12 into the tube 11. Spiral winding of the plurality of plies 12 to form a tube 11 is well understood by those of ordinary skill in the art and further explanation herein is not deemed necessary.

The concrete column forming tube further includes a centrifugally-cast epoxy resin coating 15 deposited, preferably by spraying, onto the inside wall surface 13 of the spirally-wound paper tube 11 while the tube is rotating to produce a smooth inside coated surface 16 in the forming tube 10, in a manner and by method to be described in more detail below, to eliminate the spiral seam lines and other undesirable characteristics from being molded on an outside surface of a formed concrete column.

Through experimentation, it has been found that the epoxy resin used for the coating 15 should preferably comprise about 75-95%, preferably 83%, low viscosity multifunctional resin and about 25-5%, preferably about 17%, accelerated aliphatic amine catalyst.

Various coating materials were tested for a variety of characteristics including brittleness, smoothness, absence of bubbles in the cured coating, cost, compatibility with paper, stability with moisture, abrasion resistance, low viscosity to successfully form centrifugally-casting, etc. Early testing included polyester and polyurethane as coating materials. The polyurethane offered flexibility, unlike the polyester; however, the polyester did not have bubbles in the cured surface, like the polyurethane, and it was more cost effective. Additional testing of polyester coating revealed brittleness of the coating. This characteristic is not favorable from a shipping and handling standpoint with the finished forming tube 10. Further problems were identified with the polyester coating.

Experimentation was then conducted with epoxy resin materials with various additives as the coatings. It was ultimately determined that a two-part blend of epoxy resins available from Shell Oil Company and identified as "Epi-Rez 5027" and "Epi-Cure 874" could be centrifugally-cast as a coating 15 on the inside of the spirally-wound paper tube 11 and produce a concrete column forming tube 10 having desired characteristics. It was also found through experimentation that an epoxy resin coating 15 of about 0.010-0.125 inch and preferably about .030 inch is preferable for purposes of the present invention.

It has been found that, for a standard 24 inch diameter forming tube 11, the spirally-wound plies 12 of paper should include three inside plies 12 having deckled edges 17, formed by grinding or compressing of the edges, and overlapped with each other as a result of the spiral winding. Each of these three inside plies 12 preferably have a Basis weight range of about 90-100 lbs./1000 square feet and a density range of about 3.6-4.0 lbs./point. These three inside plies 12 preferably have a width of about 7.56 inches and a thickness of about .025 inch.

It has also been found that this 24 inch standard spirally-wound paper tube 11 could have outside plies, preferably at least five, which have butted edges 18 when spirally-wound and have a Basis weight range of 70-120 lbs./1000 square feet and a density range of about 2.7-3.5 lbs./point. These outside plies preferably comprise a width of about 7.188 inches and a thickness of about .025-.035 inch. The tube 11 could also include an outside surface ply having a Basis weight range of about 70-120 lbs./1000 square feet, a density range of about 2.7-3.5 lbs./point, a width of about 7.75 inches and a thickness of about .015 inch. This thin outside surface ply provides desired outside surface characteristics on the forming tube 10.

With the above construction, the harder and more dense plies 12 forming the inside three plies 12 of the tube 11, along with their deckled overlapped edges, help in minimizing the inside spiral seam lines formed on the inside surface 13 of the tube 11 prior to centrifugally-casting the epoxy resin coating 15 thereon. Selection of the above preferred build-up of the plies 12 of the tube 11 occurred through experimentation with average sized concrete forming tubes in order to cooperate with the selected epoxy resin coating 15 to produce a smooth inside surface 16 on the forming tube 10 as desired by this invention to overcome problems previously existing with these forming tubes.

The above discussed build-up and arrangement of plies is preferred for a 24 inch diameter tube. However, there would be fewer outside plies for a smaller diameter tube and more outside plies for a larger diameter tube. It is believed possible that a suitable inside coated tube could be constructed with only three plies of the deckled and overlapped edge type. It is also believed possible to utilize only one or two of the inside deckled and overlapped edge plies with two or three outside butted edge plies and increase the preferred thickness from .030 inch to about .045 inch for the epoxy resin coating and get a smooth inside surface. Further experimentation may show that the number of deckled and overlapped edge inside plies may decrease while increasing the thickness of the epoxy resin coating.

Referring now to Figures 3-7, the preferred method of making the above described concrete column forming tube 10 is illustrated diagrammatically and schematically. Such method includes the basic steps of providing an elongate rigid cylindrical tube 11, preferably constructed as described above, and capable of receiving concrete therein to form a column, centrifugally-casting an epoxy resin coating 15 on the inside wall surface of the tube by depositing, preferably by spraying, the epoxy resin in the inside of the tube 11 and rotating the tube 11 in a horizontal position, and curing the centrifugally-cast epoxy resin coating 15.

Although various types of apparatuses, devices or mechanisms may be used, in performing the above basic method steps of this invention, applicant has found that a preferred device for receiving and positioning tube 11 in a generally horizontal position and for rotating the device could be in a form of a rotator device 20, as illustrated schematically in Figures 3-7, and which includes a frame, collectively designated by the reference numeral 21 mounted on wheels 22 carried on tracks 23 for movement in a transverse direction with respect to the tube 11. The rotator device 20 further includes rollers 24, one of which is driven, to receive the tube 11 in its horizontal position and for rotating the tube 11. A hold-down device 25 is also provided which is adapted to be swung into position over the tube 11 for holding the tube on the rollers 24 and includes a belt mechanism for rotating with the tube 11. This hold-down device 25 is adapted to be swung vertically out of hold down position for loading and unloading a tube 10 on the rotator device 20. Preferably, two rotator devices 20 are provided in parallel, side-by-side position for purposes to be described below.

The step of spraying epoxy resin coating 15 on the inside of the tube 11 may be performed by the use of a spray unit 30. This unit 30 includes a spray head 31 mounted on the end of a telescoping and reciprocating boom device 32 carried on a frame 33 supported by rollers 34 mounted on tracks 35. With this arrangement, the boom device 32 and spray head 31 may be reciprocated into and through the tube 11 while spraying the inside surface 13 of the tube 11 with the epoxy resin while the tube 11 is being rotated by the rotator device 20 and while the boom device 32 is being reciprocated out of the tube 11. Rubber bladders 36 may be positioned on each end of the tube 11 to form a dam for the epoxy resin as it is sprayed by the spray head 31 and before curing thereof to form the epoxy resin coating 15.

It has been found that a preferred epoxy resin coating 15 is centrifugally-cast onto the inside of the tube 11 when the tube is rotated at about 400-850 feet/minute and preferably about 750-850 feet/minute. The epoxy resin is sprayed by the spray head 31 at a rate of about 0.15-0.50 lbs/square foot and preferably about 0.17-0.25 lbs./square foot. The spray head 31 may be any suitable type of spray head for spraying epoxy resin material and it has been found that a air-assisted airless spray gun which is readily available for commercial purchase may be utilized.

For curing the centrifugally-cast epoxy resin coating 15 on the inside surface 13 of the tube 11, the rotator device 20 is moved in a direction transverse to the tube and away from the spray unit 30 to a heater unit 40. The heater unit 40 also includes a reciprocating boom device 42 having a suitable type of heater unit 41 thereon and being carried on a frame 43 mounted on a roller and track mechanism like the spray unit 30 for reciprocating the heater unit 41 into the inside of the tube 11 after the epoxy resin coating 15 has

been applied thereto for curing the epoxy resin coating 15. It has been found that the epoxy resin coating 15 can be satisfactorily cured if heated to a temperature of about 150 DEG -200 DEG F for a period of about 20-25 minutes.

A preferred method in accordance with this invention utilizes two rotator devices 20, as discussed above, in side-by-side parallel position and two heater units 40 respectively positioned on each side of the spray unit 30 so that tubes 11 may be positioned in side-by-side horizontal positions on the rotator devices 20 either of which can be moved back and forth in a direction transverse to the tubes 11 so that while one rotator device 20 with a tube 11 thereon is in position at the spray unit 30, the other rotator device 20 is in position in front of the respective first and second heater units 40. In this manner, the step of spraying the epoxy resin coating 15 on the inside surface 13 of the tube 11 can be performed on one tube 11 on one of the two rotator devices 20 while the other tube 11 with a centrifugally-cast coating 15 thereon can be simultaneously cured by heater unit 40 while positioned on the other rotator device 20. Also, both rotator devices 20 can be stationed at the same time at first and second heater units 40 for simultaneous curing of coating 15 on tubes 11. After curing, the finished forming tube 10 is unloaded from the respective rotator device 20 and an uncoated tube 11 is loaded onto the rotator device 20 for subsequent transverse movement into position in front of the spray unit 30. This sequence of operation conserves time since the centrifugally-casting step of the method is much faster than the curing step of the method. This sequence of steps of a method of this invention has been illustrated diagrammatically in Figure 7A, B and C.

While full details of the apparatus use for performing the method of this invention have not been fully illustrated or described herein, it is believed that sufficient details have been illustrated and described so as to fully understand the method of this invention and the preferred steps thereof.

In the drawings and specification that there has been set forth a preferred embodiment of the concrete column forming tube and method of making same in accordance with this invention, and although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention is defined in the following claims.

Claims

1. A concrete column forming tube for receiving poured concrete therein to produce a concrete column; said forming tube comprising: an elongate rigid cylindrical tube capable of receiving concrete therein to form a column and comprising spirally-wound plies of paper adhered together and defining an inside wall surface having spiral seam lines thereon; and
a centrifugally-cast epoxy resin coating sprayed onto said inside wall surface of said spirally-wound paper tube while said tube is rotating to produce a smooth inside coated surface on said forming tube to eliminate spiral seam lines and other undesirable characteristics on an outside surface of the formed concrete column.

2. A concrete column forming tube, as set forth in Claim 1, in which said epoxy resin comprises about 75-95% low viscosity multifunctional resin and about 25-5% accelerated aliphatic amine catalyst.

3. A concrete column forming tube, as set forth in Claim 1, in which said epoxy resin comprises about 83% low viscosity multifunctional resin and about 17% accelerated aliphatic amine catalyst.

4. A concrete column forming tube, as set forth in any one of claims 1 to 3, in which said centrifugally-cast epoxy resin coating has a thickness of about .010-.125 inch.

5. A concrete column forming tube, as set forth in any one of claims 1 to 3, in which said centrifugally-cast epoxy resin coating has a thickness of about .030-.045 inch.

6. A concrete column forming tube, as set forth in any preceding claim, in which said spirally-wound plies of paper of said cylindrical tube include three inside plies having deckled overlapped edges.

7. A concrete column forming tube, as set forth in Claim 6, in which each of said three inside plies comprise a paper ply having a Basis weight range of about 90-100 lbs./1000 square feet and a density range of about 3.6-4.0 lbs./point.

8. A concrete column forming tube, as set forth in claim 6 or claim 7, in which each of said three inside plies comprise a width of about 7.563 inches and a thickness of about .025 inch.

9. A concrete column forming tube, as set forth in any preceding claim, in which said spirally-wound plies of paper of said cylindrical tube include outside plies having butted edges.

10. A concrete column forming tube, as set forth in Claim 9, in which said outside plies include paper plies having a Basis weight range of about 70-120 lbs./1000 square feet and a density range of about 2.7-3.5 lbs./point.

11. A concrete column forming tube, as set forth in claim 9 or claim 10, in which said outside plies include plies comprising a width of about 7.188 inches and a thickness of about .025-035 inch.

12. A concrete column forming tube, as set forth in Claim 11, in which said spirally-wound plies of paper of said cylindrical tube include an outside surface ply having a Basis weight range of about 70-120 lbs./1000 square feet, a density range of about 2.7-3.5 lbs./point, a width of about 7.750 inches and a thickness of about .015 inch.

13. A concrete column forming tube, as set forth in Claim 11, in which said outside plies further include paper plies having a Basis weight of about 100-110 lbs./1000 square feet, a density of about 2.9-3.2 lbs./point, a width of about 7.188 inches and a thickness of about .035 inch.

14. A concrete column forming tube for receiving poured concrete therein to produce a concrete column; said forming tube comprising:
an elongate rigid cylindrical tube capable of receiving concrete therein to form a column and comprising spirally-wound plies of paper adhered together and defining an inside wall surface having spiral seam lines thereon, said spirally-wound plies comprising three inside plies having deckled overlapped edges and each having a Basis weight range of about 90-100 lbs./1000 square feet and a density range of about 3.6-4.0 lbs./point, and at least five outside plies having butted edges and having a Basis weight range of about 70-120 lbs./1000 square feet and a density range of about 2.7-3.5 lbs./point; and
a centrifugally-cast epoxy resin coating sprayed onto said inside wall surface of said spirally-wound paper tube while said tube is rotating to produce a smooth inside coated surface on said forming tube to eliminate spiral seam lines and other undesirable characteristics on an outside surface of the formed concrete column, said epoxy resin comprising about 75-95% low viscosity multifunctional resin and about 25-5% accelerated aliphatic amine catalyst, and said centrifugally-cast epoxy resin coating having a thickness of about 0.010-0.125 inch.

15. A concrete column forming tube, as set forth in Claim 14, in which said inside plies of said cylindrical tube comprise a width of about 7.563 inches and a thickness of about .025 inch, and in which at least five outside plies comprise a width of about 7.188 inches and a thickness of about .025-.035 inch.

16. Method of making a concrete column forming tube characterized by a smooth inside surface to eliminate undesirable surface characteristics on the resulting concrete column; said method comprising the steps of:
providing an elongate rigid cylindrical tube capable of receiving concrete therein to form a column and comprising spirally-wound plies of paper adhered together;
centrifugally-casting an epoxy resin coating on the inside wall surface of the tube by depositing the epoxy resin in the inside of the tube and rotating the tube in a horizontal position; and
curing the centrifugally-cast epoxy resin coating.

17. Method of making a concrete column forming tube, as set forth in Claim 16, in which said step of depositing the epoxy resin in the inside of the tube comprises spraying the epoxy resin on the inside of the tube while the tube is rotating in the horizontal position.

18. Method of making a concrete column forming tube, as set forth in Claim 17, in which said step of spraying the epoxy resin on the inside surface of the tube further comprises utilizing a spray head on the end of a reciprocating boom device and reciprocating the spray head into and through the tube while spraying the inside wall surface of the tube along its entire length as the boom device is

reciprocated out of the tube.

19. Method of making a concrete column forming tube, as set forth in claim 17 or claim 18, in which said step of rotating the tube during the step of centrifugally-casting of the epoxy resin comprises rotating the tube at about 400-850 feet/minute, and in which the step of spraying the epoxy resin on the inside wall surface of the tube comprises spraying the resin at a rate of about 0.15-0.50 lbs./square foot.

20. Method of making a concrete column forming tube, as set forth in any one of claims 17 to 19, in which said step of spraying an epoxy resin onto the inside wall surface of the tube comprises spraying an epoxy resin formed from about 75-95% low viscosity multifunctional resin and about 25-5% accelerated aliphatic amine catalyst.

21. Method of making a concrete column forming tube, as set forth any one of claims 16 to 20, in which said step of curing the centrifugally-cast epoxy resin coating further comprises heating the epoxy resin coating to a temperature of about 150 DEG -200 DEG F for period of about 20-25 minutes.

22. Method of making a concrete column forming tube, as set forth in Claim 21, in which said step of heating the centrifugally-cast epoxy resin coating further comprises utilizing a heating unit on a reciprocating boom device and reciprocating the heating unit into the inside of the tube after the epoxy resin coating has been centrifugally-cast thereon.

23. Method of making a concrete column forming tube characterized by a smooth inside surface to eliminate undesirable surface characteristics on the resulting concrete column; said method comprising the steps of:
providing an elongate rigid cylindrical tube capable of receiving concrete therein to form a column and formed of spirally-wound plies of paper adhered together;
centrifugally-casting epoxy resin coating on the inside surface of the tube by spraying the epoxy resin on the inside of the tube while rotating the tube in a horizontal position; and
curing the centrifugally-cast epoxy resin coating by heating the epoxy resin coating to a predetermined temperature for a predetermined period of time.

24. Method of making a concrete column forming tube, as set forth in Claim 23, in which said step of centrifugally-casting an epoxy resin coating on the inside wall surface of the tube further comprises utilizing an epoxy resin comprising about 75-95% low viscosity multifunctional resin and about 25-5% accelerated aliphatic amine catalyst, in which said step of rotating the tube during centrifugally-casting of the epoxy resin coating comprises rotating the tube at about 750-85 feet/minute, in which the step of spraying the epoxy resin coating on the inside wall surface of the tube comprises spraying the resin at a rate of about 0.17-0.25 lbs./square foot, and in which the step of heating to cure centrifugally-casting epoxy resin coating further comprises heating the epoxy resin coating to a temperature of about 150 DEG -200 DEG F for a period of about 20-25 minutes.

25. Method of making a concrete column forming tube characterized by a smooth inside surface to eliminate undesirable surface characteristics on the resulting concrete column; said method comprising the steps of:
positioning an elongated rigid cylindrical tube formed of spirally-wound plies of paper adhered together in a horizontal position on a rotator device which is adapted to rotate the tube and to be moved in a transverse direction with respect to the tube; ;
centrifugally-casting an epoxy resin coating on the inside surface of the tube by rotating the tube in its horizontal position by the rotator

device and by spraying an epoxy resin coating on the inside wall surface of the tube by utilizing a spray head on the end of a reciprocating boom device and reciprocating the spray head into and through the rotating tube while spraying the inside wall surface of the tube with the epoxy resin along the entire length of the tube as the boom mechanism is reciprocated out of the tube; and
curing the centrifugally-cast epoxy resin coating by moving the rotator mechanism in a transverse direction to a second position generally parallel with the first position and utilizing a heating unit positioned on a reciprocating boom device positioned generally parallel with the boom device carrying the spray device and reciprocating the heating unit into the inside of the tube and heating the epoxy resin coating to a predetermined temperature for a predetermined period of time and reciprocating the heating unit and boom device out of the tube after curing has been effected.

26. Method of making a concrete column forming tube, as set forth in Claim 25, in which said method further comprises providing two transversely-movable parallel side-by-side rotator devices for receiving the tubes thereon in the generally horizontal position, providing a second heating unit on a boom device positioned parallel with and on the other side of the boom device with the spray head on the end thereof from the first boom device with heating unit thereon and moving the two rotator devices respectively back and forth in the transverse direction of the tubes between positions at the spray head and at one of the heating devices so that the step of spraying the epoxy resin coating on the inside surface of the tube can be performed on one tube on one of the two rotator devices while the other tube with a centrifugally-cast coating therein on the other rotator device can be simultaneously cured and so that the step of curing can be carried on two tubes simultaneously while both rotor devices are respectively positioned at the first and second heating units.

27. Method of a making concrete column forming tube, as set forth in any one of claims 16 to 26, in which said step of providing an elongate rigid cylindrical tube further includes providing a tube having three inside plies with deckled overlapped edges and at least five outside plies having butted edges.

28. Method of making a concrete column forming tube, as set forth in Claim 27, in which each of the three inside plies of paper forming the tube have a Basis weight range of about 90-100 lbs./1000 square feet and a density range of about 3.6-4.0 lbs./point, and in which the at least five outside plies have a Basis weight range of about 70-120 lbs./1000 square feet and a density range of about 2.7-3.5 lbs./point.